DOCUMENT RESUME

ED 314 576 CE 053 166

AUTHOR Cannone, Richard
TITLE Electrical Trades. COM-LINK. Competency Based Vocational Curricula with Basic Skills and Academic Linkages.
INSTITUTION Ocean County Vocational Technical School, Toms River, N.J.
SPONS AGENCY New Jersey State Dept. of Education, Trenton. Div. of Vocational Education.
PUB DATE Jul 89
NOTE 132p.; For related documents, see CE 053 146-174.
PUB TYPE Guides - Classroom Use - Guides (For Teachers) (052)

EDRS PRICE MF01/PC06 Plus Postage.
DESCRIPTORS Basic Skills; Buildings; *Building Trades; Communication Skills; *Competency Based Education; Construction Industry; Construction Materials; Craft Workers; *Electrical Systems; *Electric Circuits; *Electricians; Hand Tools; Heating; Integrated Curriculum; *Lighting; Mathematics Skills; Science Instruction; Secondary Education; Shop Curriculum; Skilled Occupations; Trade and Industrial Education

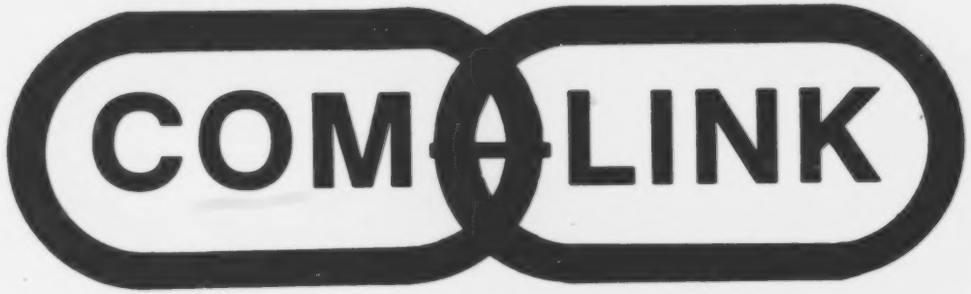
ABSTRACT

This competency-based module uses the Ocean County (New Jersey) Vocational-Technical Schools curriculum-infused model for infusing basic skills instruction into vocational education. The model demonstrates the relationship of vocational skills to communication, mathematics, and science. The document begins with a philosophy statement; preface; a table that explains the number of hours required for academic credit in various programs and the number of those hours that are devoted to basic skills and vocational activities; matrices that show in which courses specific basic skills are taught; a list of objectives; and an explanation of student activities. Most pages in the document are tables that describe the relationship of vocational skills to basic skills within the electrical trades program. These pages are organized by instructional unit and the topics within them. For each topic and associated task(s) are listed the theories and the communication, math, and science skills covered. Also listed are the expected student outcomes. The instructional units included are: orientation; electrical trades; general safety; hand tools; safety; use and installation of electrical devices; utilize national electrical code; heating and lighting; calculate Ohm's law; house wiring; residential service installation; commercial pipe layout and installation; use and maintenance of equipment; and use, installation, and troubleshooting industrial motor controls. (CML)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED314576

Competency Based Vocational Curricula



With Basic Skills And Academic Linkages

Dr. Frederick Felice, Project Director

Marilyn Halprin, Co Project Director (Project Coordinator)

In Cooperation With The

New Jersey State Department of Education

Division of Vocational Education

And

Ocean County Vocational-Technical School

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

CE053166

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

M. Halprin

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

"It is the policy of the Ocean County Vocational-Technical School not to discriminate in its technical programs, activities, employment practices, or admission policies and practices on the basis of race, color, or national origin, sex or handicap. Lack of English language skills will not be a deterrent to admission to any program at the Ocean County Vocational-Technical School."

Ocean County Vocational-Technical School

Electrical Trades

Prepared by

Richard Cannone, Instructor

Project Director
Frederick Felice, Ed. D., Assistant Superintendent

Project Coordinator and Editor
Marilyn Halprin, Supervisor of Basic Studies

Assistant Editor and Typist
Laura Vassallo

Administrative Offices
137 Bey Lea Road
Toms River, New Jersey 08753

William G. Henry, Superintendent

In cooperation with
the New Jersey Department of Education
Division of Vocational Education, Trenton, New Jersey 08625

PHILOSOPHY OF EDUCATION

The Ocean County Vocational-Technical Education Program should consist of those courses, activities and experiences which are designed to prepare students for a successful entrance in a given field of work. The program should be based upon an analysis of the worker needs of the field of work, the opportunities and requirements for entrance, and the particular characteristics and needs of the students.

We believe that:

The school should educate and train the students to live effectively in our ever-changing world.

The school should provide, for each student, intensive training toward general and specific job objectives, and setting standards of performance in keeping with the requirements of that particular field of work.

All students should evidence the interest, aptitude, and ability to profit from the specialized instruction, and this should be a condition of entrance into or continuance in a given field of work.

Equal attention should be given in the school program to develop sound character, good citizenship, ability to think critically, and maintain good mental and physical health.

The school must be constantly striving to fulfill its ultimate purpose; that of serving the students and the community. The school should give careful consideration to the needs, interests, and capacities of the students and the educational and technical background, experience, training, and professional interest of the professional staff as they develop a working philosophy of education.

PREFACE

The curriculum format employed by this project is competency based and utilizes the Ocean County Vocational-Technical Schools' curriculum infused model for the teaching of basic skills as part of vocational education. The design demonstrates the relationship of vocationally related skills to communication, mathematics and science knowledge. Proficiences with regard to student outcomes cannot be achieved without mastery in related academic areas. All student outcome objectives are predicated upon entry level skills which reflect the dictates of the job marketplace and industry. In addition, basic skills matrices developed by the district are included. The totality of this package is designed to facilitate the vocational teaching process and to enchance the learning experiences of our students.

POTENTIAL OPPORTUNITY FOR AWARDING ACADEMIC CREDITS FOR STUDENTS AT OCEAN COUNTY VOCATIONAL-TECHNICAL SCHOOL

450 hours - 1 year course at O.C.V.T.S.
900 hours - 2 year course at O.C.V.T.S.
1000 hours - 2 year Beauty Culture course

120 hours per year needed for 5 credits
60 hours per year needed for 2½ credits

COURSE	TOTAL HOURS	HOURS SPENT ON COMMUNICATION SKILLS	HOURS SPENT ON COMPUTATION SKILLS	HOURS SPENT ON SCIENCE	TIME ON OCCUPATIONAL ACTIVITIES IN CLASS OR SHOP
AIR CONDITIONING, REFRIGERATION AND HEATING	900	140	120	120	520
AUTO BODY REPAIR	900	130	120	125	525
AUTOMOTIVE MECHANICS	900	150	120	120	510
AUTOMOTIVE AND DIESEL ENGINE REBUILDING	900	216	126	125	433
BEAUTY CULTURE I AND II	1000	240	120	130	515
BUILDING TRADES	900	135	120	130	515
BUSINESS RELATIONS - MEDIA/MODELING	450	200	60	40	150
CHILD CARE AIDE	900	240	120	122	418
COMMERCIAL ART AND PRINTING	900	120	215	75	580
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	900	130	125	130	515

POTENTIAL OPPORTUNITY FOR AWARDING ACADEMIC CREDITS FOR STUDENTS AT OCEAN COUNTY VOCATIONAL-TECHNICAL SCHOOL

450 hours - 1 year course at O.C.V.T.S.
900 hours - 2 year course at O.C.V.T.S.
1000 hours - 2 year Beauty Culture course

120 hours per year needed for 5 credits
60 hours per year needed for 2½ credits

COURSE	TOTAL HOURS	HOURS SPENT ON COMMUNICATION SKILLS	HOURS SPENT ON COMPUTATION SKILLS	HOURS SPENT ON SCIENCE	TIME ON OCCUPATIONAL ACTIVITIES IN CLASS OR SHOP
COMMERCIAL PHOTOGRAPHY & TELEVISION PRODUCTION	900	150	125	80	545
CUSTOM CABINETMAKING	900	130	120	60	590
DENTAL ASSISTING	450	168	65	77	140
DESIGN DRAFTING	900	135	150	165	450
ELECTRICAL TRADES	900	106	120	124	550
FASHION MERCHANDISING	450	200	60	40	150
FOOD SERVICES	900	206	132	125	437
INDUSTRIAL AUTOMATION AND ELECTRONICS	900	129	140	132	499
INTERIOR DESIGN	900	210	130	120	440
LANDSCAPING AND GREENHOUSE TECHNOLOGY	900	125	125	175	475

POTENTIAL OPPORTUNITY FOR AWARDING ACADEMIC CREDITS FOR STUDENTS AT OCEAN COUNTY VOCATIONAL-TECHNICAL SCHOOL

450 hours - 1 year course at O.C.V.T.S.
900 hours - 2 year course at O.C.V.T.S.
1000 hours - 2 year Beauty Culture course

120 hours per year needed for 5 credits
60 hours per year needed for 2½ credits

COURSE	TOTAL HOURS	HOURS SPENT ON COMMUNICATION SKILLS	HOURS SPENT ON COMPUTATION SKILLS	HOURS SPENT ON SCIENCE	TIME ON OCCUPATIONAL ACTIVITIES IN CLASS OR SHOP
MARINE ENGINE AND BOAT SERVICES	900	164	120	125	491
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	450	173	60	77	140
MEDICAL SKILLS AND RELATED HEALTH CAREERS	450	135	65	125	125
MEDICAL SKILLS (ADVANCED)	450	125	60	125	140
PLUMBING AND HEATING	900	140	120	120	520
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	900	125	130	60	585
T.V. AND COMPUTER REPAIR	900	125	150	175	450
WELDING	900	135	120	100	545

COMMUNICATION SKILLS

Listed below are all courses offered at the Ocean County Vocational-Technical School.
The asterisk indicates that the topic is studied in that curriculum.

COURSE	Functional Reading Skills	Vocabulary	Identifying Main Ideas	Meanings in Context	Inferences	Fact/Opinion Distinction	Signal Words	Parts of Text-book/Manual	Following Directions	Outlining and Note Taking	Interpretation of Maps and Charts	Interpretation of Diagrams	Test Taking Skills	Expository Writing Skills	Problem Solving	Spelling	Oral Communications	Study Skills	Resume Writing	Job Application Skills
AIR CONDITIONING, REFRIGERATION AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AUTO BODY REPAIR	*	*		*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
AUTOMOTIVE MECHANICS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
AUTOMOTIVE AND DIESEL ENGINE REBUILDING	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BEAUTY CULTURE I AND II	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BUILDING TRADES	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
BUSINESS RELATIONS - MEDIA/MODELING/TRAVEL	*	*	*	*	*	*	*	*	*	*	*	*	*	*		*	*	*	*	*
CHILD CARE AIDE	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL ART AND PRINTING CAREERS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL PHOTOGRAPHY AND TELEVISION PRODUCTION	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
CUSTOM CABINETMAKING	*	*		*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
DENTAL ASSISTING	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*

COMMUNICATION SKILLS - CONTINUED

COURSE	Functional Reading Skills	Vocabulary	Identifying Main Ideas	Meanings in Context	Inferences	Fact/Opinion Distinction	Signal Words	Parts of Text-book/Manual	Following Directions	Outlining and Note Taking	Interpretation of Maps, Graphs and Charts	Interpretation of Diagrams	Test Taking Skills	Expository Writing Skills	Problem Solving	Spelling	Oral Communications	Study Skills	Resume Writing	Job Application Skills
DESIGN DRAFTING	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
ELECTRICAL TRADES	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
FASHION MERCHANDISING	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
FOOD SERVICES	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
INDUSTRIAL AUTOMATION AND ELECTRONICS	*	*	*		*	*			*	*	*	*	*	*	*	*	*	*	*	*
INTERIOR DESIGN	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
LANDSCAPING AND GREENHOUSE TECHNOLOGY	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
MARINE ENGINE AND BOAT SERVICE	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
MEDICAL SKILLS AND RELATED HEALTH CAREERS	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
MEDICAL SKILLS (ADVANCED)	*	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*	*	*	*
PLUMBING AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
T.V. AND COMPUTER REPAIR	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
WELDING	*	*	*			*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

MATHEMATICS SKILLS

Listed below are all courses offered at the Ocean County Vocational-Technical School. The asterisk indicates that the topic is studied in that curriculum.

COURSE	Whole Numbers	Common Fractions	Decimals	Percentages	Weights and Measurements	Ratio and Proportion	Powers and Roots	Formulas	Estimating	Geometry	Basic Trigonometric Functions	Graphs
AIR CONDITIONING, REFRIGERATION AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*
AUTO BODY REPAIR	*	*	*	*	*	*	*	*	*	*		*
AUTOMOTIVE MECHANICS	*	*	*	*	*	*	*	*	*			*
AUTOMOTIVE AND DIESEL ENGINE REBUILDING	*	*	*	*	*	*	*	*	*	*		*
BEAUTY CULTURE I AND II	*	*	*	*	*	*	*	*	*	*	*	*
BUILDING TRADES	*	*	*	*	*	*	*	*	*	*	*	*
BUSINESS RELATIONS - MEDIA/MODELING/TRAVEL	*		*	*		*			*			*
CHILD CARE AIDE	*	*	*	*	*	*		*	*	*	*	*
COMMERCIAL ART AND PRINTING CAREERS	*	*	*	*	*	*		*	*	*		*
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	*	*	*	*	*	*	*	*	*	*	*	*
COMMERCIAL PHOTOGRAPHY AND TELEVISION PRODUCTION	*	*	*	*	*	*	*	*	*	*	*	*
CUSTOM CABINETMAKING	*	*	*	*	*	*	*	*	*	*	*	*
DENTAL ASSISTING	*	*	*	*	*	*		*	*			*

MATHEMATICS SKILLS - CONTINUED

COURSE	Whole Numbers	Common Fractions	Decimals	Percentages	Weights and Measurements	Ratio and Proportion	Powers and Roots	Formulas	Estimating	Geometry	Basic Trigonometric Functions	Graphs
DESIGN DRAFTING	*	*	*	*	*	*		*	*	*	*	*
ELECTRICAL TRADES	*	*	*	*	*	*	*	*	*	*	*	*
FASHION MERCHANDISING	*	*	*	*	*	*		*	*	*		*
FOOD SERVICES	*	*	*	*	*	*		*	*	*		*
INDUSTRIAL AUTOMATION AND ELECTRONICS	*	*	*	*	*	*		*	*	*	*	*
INTERIOR DESIGN	*	*	*	*	*	*		*	*	*		*
LANDSCAPING AND GREENHOUSE TECHNOLOGY	*	*	*	*	*	*		*	*	*	*	*
MARINE ENGINE AND BOAT SERVICE	*	*	*	*	*	*		*			*	*
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	*	*	*	*	*	*	*	*	*	*		*
MEDICAL SKILLS AND RELATED HEALTH CAREERS	*	*	*	*	*	*		*	*	*	*	*
MEDICAL SKILLS (ADVANCED)	*	*	*	*	*	*		*	*	*	*	*
PLUMBING AND HEATING	*	*	*	*	*	*	*	*	*	*	*	*
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	*	*	*	*	*	*	*	*			*	*
T.V. AND COMPUTER REPAIR	*	*	*	*	*	*	*	*		*	*	*
WELDING	*	*	*	*	*	*		*	*	*	*	*

SCIENCE SKILLS

Listed below are all courses offered at the Ocean County Vocational-Technical School. Those listed as "Not Available" do not offer enough hours to qualify for credits in your high school. However, we have noted the skills covered. Those listed with an asterisk after the title are eligible. The asterisk indicates that the topic is studied in that curriculum.

	HUMAN ANATOMY						ASTRONOMY			CHEMISTRY			PHYSICS					ECOLOGY				
COURSE	Cellular Theory	Skeletal System	Muscles	System of Body	Diseases	Psychology	Solar System	Gravity	Weather	Matter	Chemical Reactions	Applied Chemistry	Light	Magnetism	Heat	Magnetism and Electricity	Nuclear Energy	Botany	Food Production	Fuels	Nutrition	Waste Disposal
AIR CONDITIONING, REFRIGERATION AND HEATING							*	*	*	*	*	*		*	*	*				*	*	
AUTO BODY REPAIR								*	*	*	*	*	*	*	*					*		*
AUTOMOTIVE MECHANICS								*		*	*	*	*	*	*	*				*		
AUTOMOTIVE DIESEL AND ENGINE REBUILDING								*		*	*	*		*	*	*	*			*		*
BEAUTY CULTURE I AND II	*	*	*	*	*	*				*	*	*	*		*	*					*	
BUILDING TRADES							*	*	*	*	*	*	*		*	*		*		*		
BUSINESS RELATIONS - MEDIA/MODELING/TRAVEL	N	* O	* T	* A	V	* A	I	L	A	B	L	E										
CHILD CARE AIDE	*	*	*	*	*	*			*		*	*		*	*			*	*		*	*
COMMERCIAL ART AND PRINTING CAREERS	N	O	T	A	V	A	I	* L	A	* B	* L	* E	*		*	*						*
COMMERCIAL BUILDING CONSTRUCTION (MASONRY)	*	*	*	*	*	*		*	*	*	*	*	*	*	*	*		*		*	*	*
COMMERCIAL PHOTOGRAPHY AND TELEVISION PRODUCTION	N	O	T	A	V	* A	I	* L	A	* B	* L	* E	*		*	*						*
CUSTOM CABINETMAKING	* N	O	T	A	V	A	I	* L	A	* B	* L	* E			*			*				
DENTAL ASSISTING	*	*	*	*	*	*				*	*	*	*								*	*

SCIENCE SKILLS - CONTINUED

COURSE	HUMAN ANATOMY						ASTRONOMY			CHEMISTRY			PHYSICS					ECOLOGY				
	Cellular Theory	Skeletal System	Muscles	System of Body	Diseases	Psychology	Solar System	Gravity	Weather	Matter	Chemical Reactions	Applied Chemistry	Light	Magnetism	Heat	Magnetism and Electricity	Nuclear Energy	Botany	Food Production	Fuels	Nutrition	Waste Disposal
DESIGN DRAFTING							*	*	*	*		*	*		*	*	*			*		*
ELECTRICAL TRADES							*	*	*	*	*		*	*	*	*	*		*			
FASHION MERCHANDISING	*	*	*	*		*		*		*	*	*	*								*	
FOOD SERVICES					*	*		*	*		*	*	*		*				*		*	*
INDUSTRIAL AUTOMATION AND ELECTRONICS								*		*			*	*	*	*	*			*		
INTERIOR DESIGN		*	*			*	*	*	*	*	*	*	*		*	*						
LANDSCAPING AND GREENHOUSE TECHNOLOGY							*	*	*		*	*	*		*	*		*	*	*	*	*
MARINE ENGINE AND BOAT SERVICE								*	*	*	*	*	*	*	*	*		*		*		
MEDICAL OFFICE RECEPTIONIST/ASSISTANT	N	* O	* T	* A	* V	* A	I	L	A	B	* L	E										*
MEDICAL SKILLS AND RELATED HEALTH CAREERS	*	*	*	*	*	*		*		*	*					*			*		*	*
MEDICAL SKILLS (ADVANCED)	*	*	*	*	*	*		*		*	*					*			*		*	*
PLUMBING AND HEATING					*		*	*	*	*	*	*			*	*		*		*		*
RECREATIONAL VEHICLE MAINTENANCE AND REPAIR	N	O	T	A	V	A	I	* L	A	* B	* L	* E	*	*	*	*				*		*
T.V. AND COMPUTER REPAIR										*	*	*	*	*	*	*				*		
WELDING								*		*	*	*	*	*	*	*				*		

COURSE OBJECTIVES

1. To prepare students with entry level skills, abilities and knowledge for employment in the electrical trades.

2. To present 900 hours of instruction and practice in the electrical trades in accordance with the course curriculum and skill profile outline.

3. To provide a detailed summary evaluation of the proficiency achieved by each student representing the most important content areas presented in the electrical trades skill profile.

4. To help each student develop positive attitudes and ideals related to their occupation in the electrical trades and understand their own capabilities and potential.

5. To instill in each student the need to plan for their professional growth through continuous learning in their chosen occupation.

STUDENT ACTIVITIES

All students enrolled in the Ocean County Vocational-Technical School are encouraged to join Vocational Industrial Clubs of America (VICA). Student activities are infused into each program. Each building has a student government and a student activities program separate from VICA. Additionally, students from each center and every class are encouraged to participate in the VICA Leadership and Job Demonstration Contests which begin in the centers and radiate throughout the district as Ocean County Vocational-Technical School inter school winners are chosen.

Student activities emphasize the basic precepts of VICA, as well as the basic tenets of democracy. Within the context, each of our programs teaches the dignity of work, high standards in trade ethics and safety, and a belief in the free enterprise economic system.

TABLE OF CONTENTS

ELECTRICAL TRADES

PHILOSOPHY OF EDUCATION..... i

PREFACE..... ii

POTENTIAL OPPORTUNITY FOR AWARDING ACADEMIC CREDITS..... iii

COMMUNICATION SKILLS..... vi

MATHEMATICS SKILLS..... viii

SCIENCE SKILLS..... x

COURSE OBJECTIVES..... xii

STUDENT ACTIVITIES..... xiii

ORIENTATION..... 1
- Observes Rules and Regulations..... 3
- Protect the Environment..... 4
- Utilization of Tools and Equipment..... 5

GENERAL SAFETY..... 6

HAND TOOLS..... 7

SAFETY..... 8
- Protect Self and Others..... 8

USE AND INSTALLATION OF ELECTRICAL DEVICES..... 9
- Receptacles..... 9
- Switches..... 10
- Meter Pans..... 11
- Panel Boxes..... 12
- Circuit Breakers..... 13

UTILIZE THE NATIONAL ELECTRICAL CODE..... 14
- Installing Equipment..... 14
- Identify Circuitry..... 15
- Wire Size..... 16
- Insulation Ratings..... 17

HEATING AND LIGHTING..... 18
- Commercial Heating..... 18
- Commercial Lighting..... 20
- Residential Heating..... 21
- Residential Lighting..... 22

CALCULATE OHMS LAW..... 23
- Amperage..... 23
- Voltage..... 24
- Resistance..... 25
- Wattage..... 26

HOUSE WIRING..... 27
- Lighting Circuits..... 27
- Power Circuits..... 28
- Heating Circuits..... 29
- Motor Circuits..... 30
- Appliances..... 31

RESIDENTIAL SERVICE INSTALLATION..... 32
- Identify and Install Cable..... 32
- Identify and Install Conduit..... 33
- Identify and Install Underground Conduit or Direct Burial..... 34
- Identify and Install Mast..... 35

COMMERCIAL PIPE LAYOUT AND INSTALLATION..... 36
- P.V.C. Conduit..... 36
- Ridged Conduit..... 37
- E.M.T. Conduit..... 38
- Bending Formula..... 39

USE AND MAINTENANCE OF EQUIPMENT..... 40
- Hand Power Tools..... 40
- Measuring Devices..... 41
- Meters..... 42
- Hydraulic Power Bender..... 43
- Electric Pipe Threader..... 44

USE, INSTALLATION AND TROUBLESHOOTING INDUSTRIAL MOTOR CONTROL..... 45
- Manual Starters..... 45
- Magnetic Starters..... 46
- Low Voltage..... 47
- External Control Stations and Selector Switches..... 48
- Transformer Control..... 49
- Three Phase Reversing Starters..... 50
- Indicator Lights..... 51
- Transistorized Relay Controls..... 52

UNIT: ORIENTATION - ELECTRICAL TRADES

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. School rules and regulations	A. Student rights and responsibilities B. Student grievance procedures C. Student expectations D. School code of discipline E. Attendance and graduation policy F. Student transfers G. Grading system H. Accidents I. Bedside instruction J. Cooperative Industrial Education (C.I.E.) K. Driving policy L. Drug and alcohol policy M. Early dismissal procedures N. Lockers O. Driver permits P. School closing procedures Q. Smoking R. Student progress reports S. Telephones T. Theft U. Tools and equipment	A. Note taking B. Filling out forms C. Oral communications D. Test taking skills E. Functional reading skills (Student Handbook)			A. The student will know what is expected of him/her for the school year in order to promote effective learning Written test B. The student will know the standards to be met within the school and classroom Written test

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
II. Student contract	A. Attendance B. Request for make-up work C. Extra help with assignments or lessons D. Homework assignments E. Requirements for each marking period (practical assignment sheet) F. Notebooks, etc. G. Sketch books H. Field trips I. Passing test grades J. Daily grading system K. Lockers L. Daily cleaning duties	A. Note taking B. Filling out forms C. Oral communications D. Test taking skills E. Functional reading skills (Student Contract)			A. The student will know what is expected of him/her for the school year in order to promote effective learning Written test B. The student will know the standards to be met within the school and classroom Written test

UNIT: ORIENTATION - CONTINUED

TOPIC: OBSERVES RULES AND REGULATIONS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Policies of the Ocean County Vocational-Technical School II. Course objective III. Attendance agreement IV. Shop rules	A. Familiarize the student with rules and regulations of the school and shop B. Discussion and explanation of the policies and the reasons for their implications C. Students will receive a handbook which will be the text of the lesson D. Student will hand copy the related information into their notes	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Test taking skills L. Expository writing skills M. Spelling N. Oral communications O. Study skills	A. Whole numbers B. Percentages		A. The student will be able to have a working knowledge of the required behavioral traits expected of him/her in the school environment B. The student will be able to demonstrate an understanding of the rules and regulations by achieving a satisfactory grade on a written evaluation

UNIT: ORIENTATION - CONTINUED

TOPIC: PROTECT THE ENVIRONMENT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Shop and classroom maintenance A. Procedure B. Relevance II. Safe use and disposal of hazardous substances III. Fire prevention methods	A. Explanation of clean-up of shop and why it is important to maintain a clean working environment B. Demonstration and explanation of the materials common to the trade that present a potential hazard to the environment C. Correct use and disposal of these items D. Fireprevention - escape routes from the shop and other related areas E. Methods of fire prevention that are relevant to the common trade practices F. Fire control devices 1. Types and their use 2. Locations of each 3. Fire reporting procedure 4. Fire drills	A. Functional reading skills B. Vocbaulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Problem solving O. Oral communications P. Study skills		A. Matter B. Chemical reactions C. Heat	A. The student will be able to correctly state the method of identifying a substance that is a potential hazard to the environment B. The student will be able to list the types of methods of disposal of the chemicals and substances that are hazardous and common to the trade C. The student will be able to demonstrate the types of fire extinguishers to be used for a specific type of fire during a simulation D. The student will be able to demonstrate the correct escape route from the shop in case of a fire E. The student will be able to demonstrate the ability to maintain a clean and safe working area

UNIT: ORIENTATION - CONTINUED

TOPIC: UTILIZATION OF TOOLS AND EQUIPMENT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Correct utilization of the tools and equipment that is integral to the program	A. Procedure to sign out tools and equipment B. Procedure to maintain the tools in a safe working order C. Principles of applied physics that relate to the tools of the trade D. General safety in the use of all tools and equipment	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Expository writing skills O. Problem solving P. Spelling Q. Oral communications R. Study skills	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Powers and roots H. Formulas	A. Light B. Magnetism and electricity C. Physics	A. The student will be able to demonstrate the correct sign out procedure of tools and equipment B. The student will be able to list the basic principles of physics that relate to the use of tools C. The student will be able to achieve a score of 100% on a written test that involves the use of tools and equipment of the program

UNIT: GENERAL SAFETY

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. General safety as per school policy	A. Explanation of safety policy B. Description of the required safety equipment to be used by each student C. Explanation of fire drill procedure 1. Exit 2. Shut down procedure D. Fire extinguishers 1. Types 2. Methods of use E. Shop safety rules F. Electrical power to work station procedure G. Pre-work safety check for electrical power H. Emergency power disconnects 1. Method 2. Location of switches I. Physical safety 1. Lifting 2. Moving items J. Hazardous material 1. Reporting 2. Handling 3. Safety procedure K. Ventilation L. Ladders 1. Use 2. Related safety M. Behavior in a shop environment N. Accident procedure	A. Functional reading skills B. Symbol interpretation C. Vocabulary D. Writing skills E. Verbal description of an abstract idea F. Diagram interpretation G. Note taking skills on related items H. Meaning in context I. Fact/opinion distinction	A. Estimation of girth (cubic) B. Whole numbers C. Decimals	A. Combustional properties B. Compound leverage C. Torque D. Center of gravity E. Chemical reactions F. Electrical current - properties of an ungrounded item G. Physical change of matter subjected to high temperature and induced field of electrical current H. Properties of metal and alloys I. Mass and momentum J. Velocity of electrical pressure	A. The student will be able to state two means of exit from shop in the event of a fire B. The student will be able to state the signal for a fire drill C. The student will be able to list the safety procedure for an emergency shut down D. The student will be able to correctly list 1. Shop safety rules 2. Pre-work electrical check at a work station 3. Electrical shut down stations E. The student will be able to demonstrate a knowledge of the use of a fire extinguisher F. The student will be able to demonstrate the method of warning of a fire G. The student will be able to identify universal symbols for hazardous material H. The student will be able to state correct safety equipment to be used when performing a specified task I. The student will be able to list correct body mechanics, posture and procedures in lifting and moving large items J. The student will be able to state the location of the first aid kit I. The student will be able to list the procedure in the event of an accident and react in a safe and correct manner in the event of an emergency

UNIT: HAND TOOLS

TOPIC:

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Hand tools common to the electrical trade	A. Explanation of hand tools B. Description of item C. Safety as related to each tool D. Correct and safe use of each tool E. Intended task of each tool	A. Functional reading skills B. Vocabulary C. Word association	A. Whole numbers and fractions B. Rule graduation	A. Force B. Physics C. Magnetism D. Lubrication	A. The student will be able to identify hand tools B. The student will be able to list safety items as related to specified tool C. The student will be able to state pre-work check for specified tool D. The student will be able to associate correct tool for a specified task E. The student will be able to maintain tools for prolonged life of item

UNIT: SAFETY

TOPIC: PROTECT SELF AND OTHERS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Safety equipment II. Hand tool safety III. Shop safety IV. Electrical safety	A. Safety equipment - instruction on the proper use of all safety equipment in the working environment B. Demonstration in the correct method of wearing the equipment C. Hand tool safety - instruction on the safe and correct method to use the hand tools of the trade D. Demonstration and explanation of the use of the tools E. Practical hands on evaluation in the use of the tools F. Demonstration on the safe use of ladders and scaffolds G. Practical hands on assignment in the use of the ladders and scaffolds common to the trade H. Orientation on the shop safety rules - students will copy the rules and be tested on the retention of the rules I. Explanation on the safe and correct techniques while working on electrical circuits, to include precautionary steps prior to any work being performed J. Demonstration on the correct method to work circuits K. Written evaluation on the content of the lesson on electrical safe working methods	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Expository writing skills O. Problem solving P. Spelling Q. Oral communications R. Study skills	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Powers and roots H. Formulas I. Estimation J. Geometry K. Basic trigometric function L. Graphs	A. Solar sysem B. Gravity C. Weather D. Matter E. Chemical reactions F. Light G. Magnetism H. Heat I. Electricity J. Nuclear energy K. Food production	A. The student will be able to demonstrate the safe and correct use of safety equipment with a written evaluation on the correct type of safety equipment to be used for a specified condition B. The student will be able to demonstrate that he/she can follow the instructions on the safe and correct use of common electrical hand tools Written evaluation C. The student will be able to demonstrate that he/she can safely use the common types of ladders and scaffolds Written evaluation D. The student will be able to demonstrate that he/she can follow the designated rules of conduct and work practices in the shop and classroom areas Written evaluation in which student will list the rules of the shop E. The student will be able to correctly answer all questions on a written evaluation on the safe techniques of working on electrical circuits F. The student will be able to demonstrate that he/she can follow the prescribed condition for this type of task

UNIT: USE AND INSTALLATION OF ELECTRICAL DEVICES

TOPIC: RECEPTACLES

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Purpose of the receptacle II. Types of receptacles III. Application of device to a specified demand	A. Safety in the use and testing of receptacles B. Discussion on the types of receptacles as per the National Electrical Code regulations C. Determining factors in the selection of the type of device to be installed in a specified location D. Safe and correct method of connection E. Correct installation technique of the typical device F. Schematical symbols of the types of devices	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meaning in context E. Parts of textbook/manual (National Electrical Code book) F. Following directions G. Test taking skills H. Problem solving	A. Whole numbers B. Percentage C. Formulas	Heat	A. The student will be able to match correct device to a specified load B. The student will be able to determine correct device as per application to location C. The student will be able to correctly connect device (polarity) D. The student will be able to safely and correctly install device E. The student will be able to perform diagnostic check of device

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Function of a switch	A. Related safety in the installation and trouble-shooting of switches	A. Functional reading skills	A. Whole numbers	A. Mechanical function of leverage	A. The student will be able to list five types of switches common to the trade
II. Types of switches	B. Mechanical function of switches	B. Vocabulary	B. Decimals	B. Heat	B. The student will be able to translate the schematic symbol of the related switches to the actual device
III. National Electrical Code regulations of switches	C. Types of switches	C. Identifying main idea	C. Ratio and proportion	C. Light	C. The student will be able to determine the correct type of switch as per circuit demand
IV. Application of switches to a specified demand of load	D. Connection of switches in a circuit	D. Meaning in context	D. Formulas	D. Electricity and magnetism	D. The student will be able to use National Electrical Code cables to determine correct size of disconnect
	E. Schematical symbols for the types of switches	E. Fact/Opinion distinction	E. Graphs		E. The student will be able to demonstrate correct and safe method of installation
	F. Determining the size (amps) of the device as related to the circuit demand	F. Signal words			F. The student will be able to correctly perform diagnostic check of specified device
	G. Determining factors in selecting the type of switch enclosure	G. Parts of textbook/National Electrical Code book			
	H. Diagnostic methods of troubleshooting a device in line	H. Following directions			
	I. Voltage/ampacity of the circuit load related to type and size of switch	I. Interpretation of diagrams			
		J. Test taking skills			
		K. Problem solving			

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Function of the meter pan	A. How the meter pan functions in a typical service	A. Functional reading skills	A. Whole numbers	A. Gravity	A. The student will be able to correctly identify three types of meter pans
II. Types of meter pans	B. Types of meter pans common to the trade	B. Vocabulary	B. Common fractions	B. Weather	B. The student will be able to perform safe and correct try-out of meter pans 1. Measurement 2. Transposing dimension of two points to a third
III. Installation methods as per National Electrical Code and local utility specifications	C. Typical installations of commercial and residential types	C. Identifying main ideas	C. Decimals	C. Chemical reaction	C. The student will be able to correctly install pan in relation to circuit breaker panel
IV. Atmospheric effect on meter pans	D. Safe and correct method of installation	D. Signal words	D. Measurement	D. Mechanical physics 1. Leverage 2. Torque	D. The student will be able to demonstrate a safe and neat mounting of device
	E. Determining the correct dimensions for installation as per related service drop	E. Parts of textbook/NEC book	E. Geometry		E. The student will be able to correctly identify conductors
	F. Correct method of identifying the conductors	F. Following directions	F. Trigonometry functions		F. The student will be able to perform correct connection of conductors to correct terminal
	G. Correct method of connection to terminals	G. Interpretation of diagrams			G. The student will be able to correctly set torque wrench and tighten all terminals to correct foot pounds
	H. Correct use of a torque wrench	H. Test taking skills			H. The student will be able to correctly associate type of conductor to use related to immediate environment
	I. Polarity testing of the completed installation	I. Problem solving			I. The student will be able to state the means of protection from corrosion
	J. Lay-out of the pan in relation to the type of service				J. The student will be able to list the National Electrical Code related tables
	K. Means of protecting the terminal connections from effects of environment				
	L. Temporary power to service change				

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Description of types of panel boxes II. Application of each type to a specified condition as per National Electrical Code III. Method of installation A. Flush mount B. Surface mount IV. Over current protection of distribution center	A. Related safety when working with panels B. Why the "Class I, II and III" panels are necessary C. Correct method to calculate for installation D. National Electrical Code articles related to panels	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Signal words E. Parts of textbook/NEC book F. Following directions G. Interpretation of maps, graphs and charts H. Interpretation of diagrams I. Test taking skills J. Problem solving K. Spelling L. Study skills	A. Whole numbers B. Common fractions C. Percentage D. Measurement E. Formulas F. Estimating	A. Magnetism B. Electricity C. Mechanical reaction	A. The student will be able to list five types of panels B. The student will be able to correctly determine the type of panel to be installed as per N.E.C. regulations C. The student will be able to correctly install the panels as per structures definition 1. Commercial 2. Residential D. The student will be able to determine size of panel E. The student will be able to determine margins of increased size by percentage of load (I/A/W N.E.C.) F. The student will be able to lay out service installation

UNIT: USE AND INSTALLATION OF ELECTRICAL DEVICES - CONTINUED

TOPIC: CIRCUIT BREAKERS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Function of a circuit breaker II. Types of circuit III. Calculating the ampacity of the device IV. Installation of circuit breakers	A. Safety in working with device B. Identifying types of circuit breakers C. Determining the correct type to use as per specifications D. Calculating the size of the breaker in amps E. Method of installation F. Schematical symbols of related devices	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Signal words E. Parts of textbook/manual (N.E.C.) book F. Interpretation of diagrams G. Test taking skills H. Problem solving	A. Whole numbers B. Decimals C. Percentage D. Formulas E. Graphs	A. Magnetism and electricity B. Mechanical reactions C. Heat	A. The student will be able to list safety precautions related to the installation of devices B. The student will be able to identify four types of circuit breakers C. The student will be able to determine the ampacity of the device D. The student will be able to calculate percentage of increase in circuit size due to type of load E. The student will be able to correctly install a specified type of breaker

UNIT: UTILIZE NATIONAL ELECTRICAL CODE

TOPIC: INSTALLING EQUIPMENT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. What is the purpose of the National Electrical Code II. How to use the Code book III. The use of the Code as a reference tool	A. Determining what sections, tables and charts are related to the articles on installing equipment B. Demonstration of a typical application of the use of the Code	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meaning on context E. Parts of textbook/manual F. Following directions G. Interpretation of charts H. Interpretation of diagrams I. Problem solving			A. The student will be able to demonstrate the use of the index of the Code book B. The student will be able to perform a research assignment using the Code book in relationship to installation of electrical equipment

UNIT: UTILIZE THE NATIONAL ELECTRICAL CODE - CONTINUED

TOPIC: IDENTIFY CIRCUITRY

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Means acceptable I/A/W National Electrical Code to identify circuitry	A. Color codes of polarity B. Position of conductors in relation to polarity C. Marking technique used in determining special conductors	A. Functional reading skills B. Identifying main ideas C. Signal words D. Parts of textbook/manual E. Following directions F. Outlining and note taking G. Interpretation of diagrams H. Interpretation of schematical symbols			A. The student will be able to state universal color codes related to polarity B. The student will be able to correctly mark conductors with correct code marks C. The student will be able to demonstrate the ability to translate meaning of color code, marks and position

UNIT: UTILIZE NATIONAL ELECTRICAL CODE - CONTINUED

TOPIC: WIRE SIZE

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Using the related tables to determine the size of current carrying conductors II. Copper/aluminum wire ampacity	A. Tables and articles related to the size of the circuits conductor B. Factors that will determine the selection of the correct size of conductor C. The de-rating factor of conductors in "free air" as opposed to enclosed wiring D. The ability of the material to the conductor to carry amperage	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meaning in context E. Parts of textbook/manual F. Interpretation of maps, graphs and charts G. Following directions H. Problem solving	A. Whole numbers B. Decimals C. Percentage D. Measurement E. Ratio and proportion F. Roots and powers G. Formula H. Geometry	A. Matter B. Heat	A. The student will be able to demonstrate the correct use of the related tables of the National Electrical Code book in determining the allowable size of conductors for a specified load B. The student will be able to determine the number of allowable conductors for a given size enclosure C. The student will be able to perform calculation to determine the size of a conductor whose size must be increased proportionally due to influence of the environment

UNIT: UTILIZE NATIONAL ELECTRICAL CODE - CONTINUED

TOPIC: INSULATION RATINGS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Function of insulation as related to voltage of a circuit	A. The material composition of an insulator	A. Functional reading skills	A. Whole numbers	A. Weather	A. The student will be able to demonstrate correct use of related articles of the National Electrical Code books
II. The effect of insulation on the ampacity of a conductor	B. The effect of a voltage on an insulator	B. Identifying main ideas	B. Common fractions	B. Matter	B. The student will be able to correctly determine the allowable ampacity of a conductor when given the average mean temperature of an area of installation
III. Choosing the alternate insulation to comply with capacity of conduit	C. Retention of heat due to magnetic field induced in a current carrying conductor and how it is affected by the amount of insulation	C. Meaning in context	C. Decimals	C. Chemical reaction	C. The student will be able to list the properties of an insulation medium
	D. The physical size of a conductor's insulation	D. Inferences	D. Percentage	D. Physical reactions	D. The student will be able to calculate the size of multiple conductors of different insulation factors to install in a conduit
	E. Chemical effect on various types of insulation	E. Fact/Opinion distinction	E. Measurement	E. Magnetism	E. The student will be able to correctly choose the allowable type of insulation related to the chemical environment of the installation Multiple choice
	F. The relationship between the area of installation and the type of insulation required	F. Signal words	F. Ratio and proportion	F. Heat	F. The student will be able to list the three related article numbers of the National Electrical Code book as rleated to ampacity
	G. Installation in conduit choosing alternate types to comply with a specific size of conduit	G. Parts of textbook/manual	G. Powers and roots	G. Electro-magnetic field	
		H. Following directions	H. Formula	H. Atomic theory of electron flow	
		I. Interpretation of graphs and charts	I. Geometry		
		J. Problem solving	J. Graphs		

UNIT: HEATING AND LIGHTING

TOPIC: COMMERCIAL HEATING

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Types of heat units that are common to the trade	A. Types of heat units that are commonly used in a commercial structure	A. Functional reading skills	A. Whole numbers	A. Weather	A. The student will be able to determine related data from units data plate
II. Related articles of the National Electrical Code that cover the topic	B. Determining the size of the circuit by units data plate	B. Vocabulary	B. Common fractions	B. Chemical reactions	B. The student will be able to calculate the required circuits for the specified heat load
III. Applied circuits for power and control of heat units	C. Use of National Electrical Code tables that specify the amperage of a conductor	C. Identifying main ideas	C. Decimals	C. Magnetism	C. The student will be able to determine the correct size conductors for the related load
	D. Use of National Electrical Code tables to determine the size of the conduit to be used	D. Meaning in context	D. Percentages	D. Heat	D. The student will be able to calculate the correct size conduit for the installation
	E. Wiring methods for areas of high mean temperatures and weather proof methods of disconnection	E. Parts of textbook/manual	E. Ratio and proportions	E. Light	E. The student will be able to state the requirements for means of disconnection I/A/W National Electrical Code
	F. Control wiring	F. Following directions	F. Measurements		F. The student will be able to demonstrate the correct terminal connections for the sub-branch feeders
	G. Low voltage methods of control wiring	G. Outlining and note taking	G. Formulas		G. The student will be able to demonstrate the correct connection of the over-current protection device
	H. Transformers and sensors line voltage connections	H. Interpretation of diagrams, etc.	H. Geometry		H. The student will be able to perform the correct bends in conduit for installation of feeders
	I. Methods of installing low voltage conductor	I. Problem solving	I. Graphs		I. The student will be able to perform correct low voltage connection to control system using the unit's schematic
	J. Interpretation of the typical wiring diagrams found on heat and air conditioning units				

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
					J. The student will be able to perform the correct diagnostic checks prior to energizing the control circuits K. The student will be able to list the safety procedure used when three phase troubleshooting is involved in rotational test of unit's electrical motors

TOPIC: COMMERCIAL LIGHTING

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Schematical symbols common to commercial lighting	A. Types of fixtures that are used in commercial wiring	A. Functional reading skills	A. Whole numbers	A. Light	A. The student will be able to list schematical symbols of typical types of commercial lighting fixtures
II. High voltage lighting fixtures	B. Reason for the different types of fixtures	B. Vocabulary	B. Common fractions	B. Magnetism	B. The student will be able to state safety required in working with high discharge systems
III. Lighting circuit load calculations	C. Safety in the wiring of a high discharge lighting system	C. Identifying main ideas	C. Measurement	C. Heat	C. The student will be able to demonstrate the use of the related code article when researching information related to commercial lighting installation
IV. Methods of layout for lighting fixtures	D. Related code articles on the related topic	D. Inferences	D. Ratio and proportion		D. The student will be able to draw a typical wiring diagram of a contactor control system
V. Calculations for light loss in lums per square foot	E. Typical wiring of a system of 227V./ 440V./ 208V.	E. Meaning in context	E. Power and roots		E. The student will be able to wire a low voltage control contactor lighting system
VI. Installation techniques for high discharge lighting fixtures	F. Methods of controlling the lighting circuits	F. Signal words	F. Formulas		F. The student will be able to demonstrate the correct use of test equipment when connecting the low voltage control system
VII. Recess lighting fixture housing installation methods	G. Automatic/computer control lighting	G. Parts of textbook/manual and code book	G. Estimating		G. The student will be able to perform a layout of a lighting floor plan, dividing a specified space into the correct spaces for the installation of lighting fixtures
VIII. Review of safety for the use of scaffolding	H. Contactor control of light systems	H. Note taking	H. Geometry		H. The student will be able to demonstrate the correct method of wiring a typical commercial light fixture
	I. Circuit distribution of lighting load for a balanced panel	I. Interpretation of graphs and charts	I. Basic trigonometry function		
	J. Measuring light loss with a light meter	J. Problem solving	J. Graphs		
	K. Calculations of distance from work surface to face of light fixtures to comply with specifications				
	L. Grounding high voltage systems				
	M. Installation of typical types of lighting fixtures				
	N. Troubleshooting systems of high voltage secondary				

UNIT: HEATING AND LIGHTING - CONTINUED

TOPIC: RESIDENTIAL HEATING

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Types of heat units that are used in residential dwellings	A. Explanation of the types of heat units common to dwellings	A. Functional reading skills	A. Whole numbers	A. Weather	A. The student will be able to list the National Electrical Code requirements for wiring of domestic heat systems
II. National Electrical Code requirements for the electrical wiring of units	B. Areas of responsibility for the electrician	B. Vocabulary	B. Common fractions	B. Chemical reactions	B. The student will be able to demonstrate the correct wiring of a typical heat system
III. Methods of wiring heating units	C. Line voltage wiring of heat units	C. Meanings in context	C. Decimals	C. Light	C. The student will be able to interpret the schematical diagram for the wiring of the thermostatic control devices of a unit
IV. Heat loss calculation for electric baseboard heat	D. Installation methods of wiring for heat units	D. Parts of textbook/manual	D. Percentages	D. Heat	D. The student will be able to demonstrate the heat loss load for a specified area
V. Load calculation for an electric heat system	E. Low voltage thermostatic control wiring for units	E. Following directions	E. Measurements	E. Electricity	E. The student will be able to list the heat loss formula
VI. Thermostatic control wiring for heat units	F. Heat loss calculations for load calculation of electrical baseboard heat system	F. Interpretation of charts	F. Formulas	F. Magnetism	F. The student will be able to demonstrate the proper method of installing an electrical baseboard heat unit
	G. Wiring methods for electrical baseboard heat	G. Problem solving			G. The student will be able to perform installation and connection of high voltage thermostats
	H. Thermostatic control wiring for electrical baseboard heat				H. The student will be able to demonstrate the method of troubleshooting thermostatic control systems

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. National Electrical Code requirements for lighting a residential dwelling	A. Amount of lighting outlets required by the National Electrical Code	A. Functional reading skills	A. Whole numbers	A. Light	A. The student will be able to list dimensions of lighting outlets as per National Electrical Code requirement
II. Lighting load calculations	B. Layout of lighting fixtures	B. Vocabulary	B. Common fractions	B. Electricity	B. The student will be able to calculate the amount of amperage for a total load of lighting outlets
III. Typical lighting fixtures and methods of installation	C. Wiring of fixtures	C. Identifying main ideas	C. Decimals		C. The student will be able to demonstrate the methods of splicing the control devices for the specified type of lighting fixture
IV. Task lighting	D. Circuits for lighting loads	D. Meanings in context	D. Formulas		D. The student will be able to demonstrate the correct method of layout for lighting outlets
V. Decorative lighting	E. Splices for control devices	E. Inferences	E. Graphs		E. The student will be able to demonstrate the correct means of troubleshooting a lighting circuit
VI. Low voltage lighting control systems	F. Schematical symbols for special purpose lighting outlets	F. Fact/Opinion distinction	F. Measurements		F. The student will be able to demonstrate the correct wiring circuits for a low voltage control lighting system
	G. Installation of lighting outlets	G. Parts of textbook/manual			
	H. Closed wall (concealed) wiring methods	H. Following directions			
	I. Testing methods for lighting circuits	I. Interpretation of diagrams			

UNIT: CALCULATE OHMS LAW

TOPIC: AMPERAGE

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Amperage	A. Explanation of the factor of amperage B. An example of intensity of the flow of electrons in a circuit C. The mathematical formula for the calculations of amperage load in a circuit D. The relation between amperage and the physical size of the conductive medium of the circuit E. Experiments in lab on the effects of amperage on the related factors of voltage and resistance within a circuit F. The rating of over current protection devices as related to amperage G. Amperage as related to a ground fault interrupter protection circuit; induced voltage from a flow of current with a determined amount of amperage	A. Functional reading skills B. Vocabulary C. Meanings in context D. Parts of textbook and code book E. Interpretation of graphs F. Interpretation of charts G. Problem solving H. Test taking skills	A. Whole numbers B. Common fractions C. Decimals D. Percentage E. Ratio and proportion F. Formulas G. Graphs	A. Matter B. Electron theory C. Magnetism and electrical current theory	A. The student will be able to comprehend and apply the principles of electrical current B. The student will be able to compute for amperage using formula of Ohms law C. The student will be able to use measurements from meters with formula D. The student will be able to use charts and graphs of the National Electrical Code book to formulate an answer to a specific load E. The student will be able to make use of the related tables in the code book to determine the correct size of conductor for the determined load in amps

UNIT: CALCULATE OHMS LAW - CONTINUED

TOPIC: VOLTAGE

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Voltage	A. Explanation of the voltage factor B. Example of the electron pressure of a flow of current C. The math formula involved with the calculations on voltage D. The relation of voltage to the factors of a current flow E. Experiments on the amount of voltage to a given load, the effects of over and under quantities of voltage to a predetermined load factor F. The effects of a quantity of voltage on a resistance of specific value G. The effects of voltage on an insulating medium H. The safety involved with working with high voltage current	A. Functional reading skills B. Vocabulary C. Meaning in context D. Interpretation of graphs E. Interpretation of articles and regulations in the code book F. Problem solving	A. Whole numbers B. Common fractions C. Decimals D. Percentage E. Ratio and proportion F. Formulas G. Tables and graphs	A. Matter B. Electron theory C. Magnetism and electical theory D. Generation of voltage by mechanical means E. Chemical reaction in relation to the generation of voltage	A. The student will be able to comprehend and apply the principles of voltage B. The student will be able to compute, with formula and the use of measuring device, the amount of voltage present in a circuit C. The student will be able to use the formula related to voltage D. The student will be able to determine the insulation factor for the given amount of voltage present in a conductor E. The student will be able to demonstrate a safe method of working with high voltage circuits

UNIT: CALCULATE OHMS LAW - CONTINUED

TOPIC: RESISTANCE

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Resistance	A. Explanation of the resistance factor in a conductive medium B. The effects of resistance on a flow of current C. The related formula of Ohms law D. Methods of calculation with the factors of a current using Ohms law	A. Functional reading skills B. Vocabulary C. Meaning in context D. Parts of textbook E. Interpretation of graphs and charts F. Problem solving G. Test taking skills	A. Whole numbers B. Common fractions C. Decimals D. Percentage E. Ratio and proportion F. Formula G. Graphs	A. Matter B. Electron theory C. Magnetism and electrical current	A. The student will be able to comprehend and apply the principles of electrical resistance on the flow of electrical current B. The student will be able to compute for the amount of resistance in a circuit using Ohms law C. The student will be able to use the related charts and tables in the National Electrical Code book for resistance voltage drop D. The student will be able to determine the size of a conductor with the resistance factor taken into consideration

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Wattage	A. Explanation of the factor of wattage in an electrical circuit B. The effect of wattage on a demand of current in a given circumstance C. Means of calculation to determine the amount of wattage in a load D. The use of measuring devices to determine a presence of wattage	A. Functional reading skills B. Vocabulary C. Meaning in context D. Parts of textbook E. Use of the code book F. Problem solving	A. Whole numbers B. Common fractions C. Decimals D. Percentage E. Ratio and proportion F. Formula G. Graphs and charts	A. Matter B. Horsepower and mechanical reaction C. Electrical theory D. Electromechanical work E. Chemical reaction	A. The student will be able to comprehend and apply the principles of electrical current and demand load B. The student will be able to demonstrate the correct use of the related formula C. The student will be able to correctly interpret related data

UNIT: HOUSE WIRING

TOPIC: LIGHTING CIRCUITS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Lighting circuits	A. Definition of a calculated load for lighting B. Formula for the determination of the size of a circuit C. Typical layouts of a lighting circuit D. Splices for control wiring of lighting circuits E. Related material, switch and device types common to the trade F. Special areas of lighting 1. Task 2. Decorative 3. Special conditions G. Installation methods for the circuits and devices H. National Electrical Code related articles	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills M. Expository writing skills O. Problem solving P. Spelling	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Powers and roots H. Formulas I. Estimation J. Geometry K. Graphs	A. Light B. Heat C. Magnetism and electricity	A. The student will be able to define the term "lighting circuit" B. The student will be able to calculate the number of outlets per circuit using Ohms law C. The student will be able to layout and install a typical lighting circuit D. The student will be able to assemble and install a typical lighting fixture E. The student will be able to perform the correct splice for control wiring of a lighting circuit F. The student will be able to list three types of control devices for a lighting circuit G. The student will be able to perform an installation of a specified type of lighting circuit H. The student will be able to use National Electrical Code related tables for the correct installation of a lighting circuit

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Power circuits and sub-branch feeders	A. Discussion on the function of the circuits 1. What they are 2. Where they originate 3. Where they terminate B. The identification of the circuits and how the specialty branch feeders must be identified at the distribution panel C. The voltages and amperage of the circuits and how they are determined D. The installation of the circuits E. Termination methods at the beginning of the circuits	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of diagrams, etc. L. Problem solving M. Oral communications	A. Whole numbers B. Percentages C. Weights and measurements D. Ratio and proportion E. Formulas F. Estimation	A. Magnetism B. Electricity	A. The student will be able to define a power circuit B. The student will be able to demonstrate the method of identification of a specified circuit C. The student will be able to determine the size of the circuit when a given voltage and amperage is specified D. The student will be able to correctly install the circuit to a specified location E. The student will be able to demonstrate the skill in determining the termination of the circuit

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Electrical baseboard heat circuits II. Oil fired domestic heat circutis III. Gas fired domestic heat circuits	A. Explanation of how to calcuate a heat loss for domestic electric baseboard heat B. Method to calculate the total load for the entire dwelling C. Distribution techniques for the individual heaters D. Positioning of the heaters E. Installation methods on various wall surfaces F. Thermostatic wiring for electric heat G. Splices for heat H. Discussion on other types of domestic heat systems I. Troubleshooting a heat system J. Related information from the National Electrical Code on installation and wiring of electric heat (all types) K. BOAC and NEC code requirements for oil fired domestic heat systems L. Electrician's responsibilities for wiring the system M. Typical installation methods of the required circuits N. Low voltage thermostatic control wiring for heat units O. Circuit installation methods, including disconnects P. BOAC and NEC related codes for domestic gas fired heat systems Q. Electrician's areas of responsibilities in wiring the heat unit R. Typical methods of installation of wiring S. Low voltage control circuits including air conditioning T. Circuit installation techni-	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, charts and graphs L. Interpretation of diagrams, etc. M. Test taking skills N. Problem solving O. Spelling	A. Whole numbers B. Common fractions C. Percentages D. Weights and measurements E. Ratio and proportion F. Powers and roots G. Formulas H. Estimation I. Graphs	A. Weather B. Matter C. Light D. Heat E. Magnetism and electricity	A. The student will be able to demonstrate the method to calculate a heat loss for a specified area in a domestic dwelling for electrical heat systems B. The student will be able to install control wiring for heaters C. The student will be able to determine the amount of heat units for a specified area in a dwelling D. The student will be able to layout and install the correct size circuits for a power circuit for electrical heat E. The student will be able to diagnose heat malfunctions in a control wiring circuit F. The student will be able to determine the size of the required feeders for oil and gas fired domestic heating systems G. The student will be able to perform control wiring splices for these types of heat units

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Sub-branch feeder for domestic motors A. 110 VAC B. 230 VAC	A. Definition of a motor circuit B. Methods to determine the size and voltage of the circuit from available data on the unit C. Use of the related table in the National Electrical Code book D. Methods of installation E. Methods of required means of disconnection F. Control wiring for motor circuits G. Wiring method common to the trade H. Troubleshooting techniques for motor circuits	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Expository writing skills O. Problem solving P. Spelling Q. Oral communication R. Study skills	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Powers and roots H. Formulas I. Estimation J. Geometry K. Graphs	A. Weather B. Light C. Magnetism and electricity D. Heat	A. The student will be able to define a motor circuit B. The student will be able to calculate the size and type of conductor for a specified type and size of motor C. The student will be able to demonstrate skill in the use of the related National Electrical Code articles and tables D. The student will be able to correctly install the required circuitry for the common domestic motor load E. The student will be able to list the regulations of the National Electrical Code on installation of a disconnect F. The student will be able to interpret the wiring diagram supplied with the motor as connection terminal G. The student will be able to correctly install any related device for a motor in a domestic location H. The student will be able to demonstrate acceptable ability in diagnosing disfunction in a motor circuit

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Wiring for appliances	A. National Electrical Code articles on domestic dwelling appliances B. Means of interpretation of manufacturers' data for load C. Means of disconnection for various typical types of appliances D. Circuit installation methods E. Receptacles for designated use of appliances	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Interpretation of diagrams, etc. K. Problem solving	A. Whole numbers B. Weights and measurements C. Formulas D. Graphs	A. Heat B. Magnetism and electricity	A. The student will be able to distinguish what is considered an appliance under the definition as per the National Electrical Code related articles B. The student will be able to determine the size of the circuit required for the stated load as per manufacturers' data C. The student will be able to install correct wiring for such D. The student will be able to list the acceptable types of disconnects in accordance with the National Electrical Code E. The student will be able to determine the type of receptacle for the device in question F. The student will be able to perform diagnostic check of function of device

UNIT: RESIDENTIAL SERVICE INSTALLATION

TOPIC: IDENTIFY AND INSTALL CABLE

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Service entrance cable	A. Explanation of the reason to use cable as a service entrance conductor B. Discussion on the types of cable related to the type of main disconnect required by the local utility C. Related articles of the National Electrical Code D. Methods of calculating the method of installation in relation to the distribution center E. Methods of preparing the cable for installation F. Methods of installing the cable G. Methods of anchoring the cable to the structor	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Parts of textbook/manual H. Following directions I. Interpretation of diagrams, etc. J. Test taking skills K. Problem solving	A. Whole numbers B. Common fractions C. Weights and measurements D. Estimation E. Graphs	A. Weather B. Magnetism and electricity	A. The student will be able to identify the cable B. The student will be able to list the National Electrical Code article numbers C. The student will be able to determine the correct means of installation in relation to the distribution center D. The student will be able to correctly prepare the cable for a specified type of installation E. The student will be able to correctly anchor the cable to the structor

UNIT: RESIDENTIAL SERVICE INSTALLATION - CONTINUED

TOPIC: IDENTIFY AND INSTALL CONDUIT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Conduit service drop	A. Explanation of why conduit is used as a service drop B. Discussion on the types and methods of a conduit service C. Related National Electrical Code articles on this type of service drop D. Method of layout for a conduit service E. Preparing the conduit for installation F. Method of calculating the position of the drop in relation to the distribution panel G. Related fittings and hardware for this type of service H. Installation techniques I. Methods of anchoring the conduit to the building J. Installation and identification of service wires	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of diagrams, etc. L. Test taking skills M. Problem solving	A. Whole numbers B. Common fractions C. Weights and measurements D. Estimation	A. Weather B. Magnetism C. Magnetism and electricity	A. The student will be able to identify the reason for a conduit service drop B. The student will be able to list the National Electrical Code articles related to this method of installation C. The student will be able to correctly layout for a conduit service D. The student will be able to correctly prepare the conduit for installation E. The student will be able to correctly position the conduit in relation to distribution panel F. The student will be able to recognize related fittings and hardware G. The student will be able to demonstrate correct and safe methods of installation H. The student will be able to correctly anchor conduit to the structor I. The student will be able to correctly identify conductors for service drop

UNIT: RESIDENTIAL SERVICE INSTALLATION - CONTINUED

TOPIC: IDENTIFY AND INSTALL UNDERGROUND CONDUIT OR DIRECT BURIAL

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Underground conduit or direct burial conductor service	A. Explanation of why services are installed underground B. Related National Electrical Code articles on both cable and conduit C. Methods of installation D. Material used in this type of service E. Methods of trench layout F. Precautionary means for non metallic conduit burial G. Locations suitable for the installation	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Problem solving	A. Whole numbers B. Common fractions C. Weights and measurements D. Estimation E. Geometry F. Graphs	A. Matter B. Chemical reactions C. Heat D. Magnetism and electricity	A. The student will be able to identify circumstances that warrant an underground service B. The student will be able to list the related National Electrical Code articles C. The student will be able to list the method of layout for this type of service D. The student will be able to list the precautionary means for a P.V.C. service E. The student will be able to list the method of trench layout NOTE: Due to the unavailability of suitable digging medium, all lessons on underground services will be theory only

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Identifying and installing a mast service	A. Explanation of what a mast service is B. Explanation of the prerequisite for this type of service C. Methods of layout for the mast D. Method of determining the position of rafters for installation of conduit E. Related National Electrical Code articles F. Method of installation of mast G. Weatherproofing the installation H. Securing and anchoring the mast portion and the service drop I. Termination of the mast head	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Interpretation of diagrams, etc. K. Test taking skills L. Problem solving	A. Whole numbers B. Common fractions C. Percentages D. Weights and measurements E. Estimation F. Geometry G. Graphs	A. Weather B. Magnetism and electricity	A. The student will be able to determine the need for a mast type service B. The student will be able to demonstrate the correct method of layout in relation to the building's rafters C. The student will be able to correctly position the mast in relation to the position of distribution center D. The student will be able to demonstrate the correct method of cutting the roofing material for a tight weatherproof installation E. The student will be able to list the related National Electrical Code articles F. The student will be able to demonstrate the correct installation method of the mast G. The student will be able to perform all functions that will render the installation weatherproof H. The student will be able to perform the correct method of anchoring the service

UNIT: COMMERCIAL PIPE LAYOUT AND INSTALLATION

TOPIC: P.V.C. CONDUIT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. P.V.C. conduit	A. Explanation of the material of the composition B. The typical application of this type of conduit in the trade environment C. Related articles of the National Electrical Code D. Methods of use E. Bending methods and the formulas related to performing the bends F. Methods of bending G. Methods of installation	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Interpretation of diagrams, etc. K. Test taking skills L. Problem solving	A. Whole numbers B. Percentages C. Weights and measurements D. Common fractions E. Formulas F. Estimation G. Basic trigometric function	A. Chemical reactions B. Heat C. Magnetism and electricity	A. The student will be able to list the National Electrical Code article that covers the use and installation of the conduit B. The student will be able to state the grounding requirements for P.V.C. C. The student will be able to demonstrate three typical bends in the conduit D. The student will be able to identify the related fittings

TOPIC: RIDGED CONDUIT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Ridged conduit	A. Explanation of the material of composition B. The typical application of this type of conduit in the trade environment C. Related articles of the National Electrical Code D. Methods of use E. Bending formulas and methods of bending F. Bending tools G. Threading and cutting H. Methods of installation	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Signal words F. Parts of textbook/manual G. Following directions H. Outlining and note taking I. Interpretation of diagrams, etc. J. Test taking skills K. Problem solving	A. Whole numbers B. Common fractions C. Weights and measurements D. Formulas E. Estimation F. Geometry G. Basic trigometric function	A. Chemical reactions B. Magnetism C. Heat D. Magnetism and electricity	A. The student will be able to list the related National Electrical Code article numbers B. The student will be able to demonstrate the identification of the application of ridged conduit C. The student will be able to perform the correct bends in the conduit D. The student will be able to cut and thread conduit to a specified dimension E. The student will be able to identify the typical related fittings F. The student will be able to install correctly the conduit

UNIT: COMMERCIAL PIPE LAYOUT AND INSTALLATION - CONTINUED

TOPIC: E.M.T. CONDUIT

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. E.M.T. conduit	A. Explanation of material of composition B. Typical application of this conduit in the trade environment C. Related articles in the National Electrical Code D. Methods of use E. Bending methods and the formulas related to the correct bending techniques F. Types of mechanical and power benders G. Typical types of fittings and hardware H. Methods of installation	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Parts of textbook/manual G. Following directions H. Outlining and note taking I. Interpretation of diagrams, etc. J. Test taking skills K. Problem solving	A. Whole numbers B. Common fractions C. Weights and measurements D. Formulas E. Estimation F. Geometry G. Basic trigometric function	A. Chemical reactions B. Heat C. Magnetism and electricity	A. The student will be able to list the related National Electrical Code article numbers B. The student will be able to demonstrate the identification of the application of E.M.T. conduit C. The student will be able to perform correct bends in the conduit D. The student will be able to install the correct type of fittings E. The student will be able to demonstrate the correct installation of the conduit to a specified configuration

TOPIC: BENDING FORMULA

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Bending formula for the following configurations of bends in conduit A. The 90° bend B. 90° back-to-back C. 10° x 10° box off-set D. Off-sets 1. 30° 2. 45° 3. 60° 4. saddle bends of like degrees of bend	A. The principle of bending B. The use of a protractor C. The reference points on a typical manual bender D. The method to calculate the degree of bend with measurement E. Formula to calculate positioning of the bender to the conduit F. The various degrees of bend common to the trade G. Means of calculating which bend relates best to the plane of installation H. Assigned projects which will allow the student to have hands on practical exercise	A. Functional reading skills B. Vocabulary C. Meanings in context D. Parts of textbook/manual E. Following directions F. Interpretation of maps, graphs and charts G. Interpretation of diagrams, etc. H. Problem solving	A. Whole numbers B. Common fractions C. Measurements D. Powers and roots E. Formulas F. Geometry G. Basic trigometric function H. Graphs		A. The student will be able to recognize which bend is best for the specified configuration B. The student will be able to state and/or list the formula for the 10° x 10° bend C. The student will be able to demonstrate the use of the bending tables for a series of bends covered in text of lesson D. The student will be able to perform the bends specified in a task assignment E. The student will be able to configure the total amount of degrees of bend per intallation run

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Hand power tools A. Drilling tools B. Cutting tools	A. Hand power tools used for drilling steel, wood, and masonry material 1. Safety precautions when using these tools 2. Pre-work check of tools - what to check for on the tool 3. Correct selection of the bit for the type of material to be drilled 4. Method of use related to the specific task and tool 5. Demonstration on the use of the tool 6. Assigned task involving the use of the tool 7. Observation and critique of the student's performance of the task with the tool B. Hand power tools used for cutting 1. Related safety in the use of the cutting tools 2. Pre-work check of the tool 3. Types of blades for the type of material to be cut 4. Methods of use of the related tool 5. Demonstration of the correct use of the specified tool 6. Layout of the material to be cut and/or drilled 7. Assigned task with the specified cutting tool 8. Observation and critique of the student's performance of the task with the tool	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of diagrams, etc. L. Test taking skills M. Problem solving	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Estimation G. Geometry H. Basic trigometric function	A. Heat B. Magnetism and electricity	

UNIT: USE AND MAINTENANCE OF EQUIPMENT - CONTINUED

TOPIC: MEASURING DEVICES

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Measuring device II. Common ruler III. Scale ruler	A. Pre test on skills with the ruler B. Ability to correctly read a ruler C. Demonstration on the ruler D. Fractional dimensions of the ruler E. Use of the scale ruler F. Demonstration and explanation of the correct use of the scale ruler G. Assigned tasks using a specified blueprint of a dwelling in scale H. Transcription of the print's dimensions to a corresponding module for installation of electrical equipment to specified dimensions	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Problem solving O. Spelling P. Oral communications Q. Study skills	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Geometry H. Basic trigometric function I. Graphs		A. The student will be able to use the common ruler for taking and transferring a dimensional reference B. The student will be able to demonstrate his/her ability with two types of measuring devices 1. Common ruler with graduations to 1/16 2. Architectural scale C. The student will be able to show a moderate level of skill on an assigned task on measuring devices

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Voltage tester II. Multimeter III. Amp meter IV. Continuity tester	A. The safety related to the use of meters in the trade B. The voltage tester C. Correct reading of the voltage tester D. Determining which meter to use in taking a current reading E. Correct connection of the multimeter for the reading of 1. Voltage 2. AC and DC 3. Measurement of resistance of a circuit and/or device F. Interpretation of the scale of the multimeter G. Safe and correct method of connecting an amp meter to a circuit of AC and DC current H. Pre test for voltage and testing the continuity in a circuit with a self powered continuity tester	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Problem solving	A. Whole numbers B. Decimals C. Percentages D. Weights and measurements E. Ratio and proportion F. Powers and roots G. Formulas H. Basic trigometric function I. Graphs	A. Magnetism B. Magnetism and electricity	A. The student will be able to determine the correct sequence of safety precautions to be used prior to any type of measurement with a meter B. The student will be able to take a voltage reading with a standard voltage tester and demonstrate the correct use of the device C. The student will be able to set a multi-meter to the correct factor setting and voltage or amperage range to complete a specified task D. The student will be able to demonstrate the method to determine a factor of a current using the meter E. The student will be able to list the pre-work check of a circuit prior to the use of a continuity tester F. The student will be able to demonstrate the correct use of a continuity tester G. The student will be able to correctly connect an amp meter to both an AC and DC circuit and determine the correct amperage in the circuit

UNIT: USE AND MAINTENANCE OF EQUIPMENT - CONTINUED

TOPIC: HYDRAULIC POWER BENDER

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Hydraulic conduit bender	A. Explanation of the use of the tool B. Demonstration of the set up and pre work check of the tool C. Discussion on the principles of hydraulic power and how it works D. Safety precautions to be practiced when using this tool E. Explanation of the tool's integral protractor F. Calculation of radius of bend G. Division of degrees of angle to achieve a composite type bend H. Demonstration of the use of the tool on the correct type of conduit I. Assigned task for the practical use of the tool J. Observation and comment on the task performance of the student	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Interpretation of maps, graphs and charts K. Interpretation of diagrams etc. L. Test taking skills M. Problem solving	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Powers and roots H. Formulas I. Estimation J. Geometry K. Basic trigometric function L. Graphs	A. Physics of fluid compression B. Mechanical advantage C. Matter	A. The student will be able to demonstrate the safe and correct set up of the bender B. The student will be able to perform correctly the pre work check of the bender for mechanical and fluid integrity C. The student will be able to calculate a radius of bend for a specified bend of necessary degrees D. The student will be able to perform the bend correctly in accordance with the dimensional requirement of the National Electrical Code E. The student will be able to state the formula for determining of a configuration of bend in the correct degree to a solid objective

UNIT: USE AND MAINTENANCE OF EQUIPMENT - CONTINUED

TOPIC: ELECTRIC PIPE THREADER

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Electrical pipe cutter/ threader	A. Explanation of the cutter/ threader B. Discussion on the mechanics involved C. Demonstration on the safety that is required when using this device D. Explanation of the variable dies E. Discussion on how to set the dies for the correct size and type of threading to be done F. Demonstration on the procedure in cutting and reaming a pipe G. Demonstration on how to set the floating dies for the correct pitch of thread H. Demonstration of the type of required task that will be assigned I. Explanation of the requirement of the National Electrical Code related to the subject J. Series of assigned tasks that will encompass the text of the lesson	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of diagrams, etc. L. Test taking skills M. Problem solving	A. Whole numbers B. Common fractions C. Weights and measurements D. Ratio and proportion E. Formulas F. Estimation G. Graphs	Friction 1. Composition of metal, alloys and the effect of heat 2. Mechanical advantage of the planetary gears of the cutter/threader 3. Lubrication properties	A. The student will be able to perform the pre work check of the machine B. The student will be able to demonstrate the required safety when using the machine C. The student will be able to state the required pitch of thread that is stated in the National Electrical Code book D. The student will be able to correctly cut a specified length of pipe E. The student will be able to demonstrate his/her skill in correctly setting the floating dies to the correct dimension for a predetermined size of pipe

UNIT: USE, INSTALLATION AND TROUBLESHOOTING INDUSTRIAL MOTOR CONTROL

TOPIC: MANUAL STARTERS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Manual starters A. 120 VAC single phase B. 240 VAC single phase C. 208 VAC three phase	A. Explanation of the device related to the National Electrical Code articles on the subject B. Explanation of the function of the device C. Demonstration of a typical application of the device D. Notes on the method to calculate the size required for the determined load E. Wiring diagrams of typical devices F. Demonstration of the related safety on this unit G. Example of wiring a typical device H. Assigned tasks with a schematical diagram for the wiring of the device I. Evaluation on gained skills	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Signal words G. Parts of textbook/manual H. Following directions I. Outlining and note taking J. Interpretation of maps, graphs and charts K. Interpretation of diagrams, etc. L. Test taking skills M. Problem solving	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Formulas F. Graphs	A. Magnetism B. Magnetism and electricity	A. The student will be able to identify three types of manual starters B. The student will be able to state the purpose of the device C. The student will be able to demonstrate the use of National Electrical Code tables that relate to the topic D. The student will be able to demonstrate the correct wiring of the three types of devices covered in the unit

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Magnetic starters A. 120 VAC B. 240 VAC C. 208 three phase	A. Explanation of the difference between a magnetic and manual starter B. Operational function of normally open and normally closed contacts C. Explanation of the typical connections of a device to a load D. Interpretation of the typical schematical instructions for magnetic starters E. Installation techniques that are commonly employed in the trade F. Typical exercise with relays	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Signal words F. Parts of textbook/manual G. Following directions H. Outlining and note taking I. Interpretation of maps, graphs and charts J. Interpretation of diagrams, etc.	A. Whole numbers B. Decimals C. Percentages D. Graphs	A. Magnetism B. Magnetism and electricity	A. The student will be able to state the purpose of a magnetic starter B. The student will be able to identify the three types of starters covered in text of lesson C. The student will be able to interpret the symbols of related schematic language D. The student will be able to demonstrate the skill of wiring the related devices

TOPIC: LOW VOLTAGE

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Related low voltage	A. Purpose of a combined voltage system in relation to the topic B. Sources of the low voltage C. Definition of the term D. Related National Electrical Code articles that cover the use of multi-voltage circuitry in motor control E. Typical control/operational circuits related to topic F. Schematical symbol interpretation of the circuits G. Demonstration of a typical wiring of the multi-circuit wiring H. Practical demonstration of a unit in function I. Assigned task related to topic J. Evaluation of gained skills	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Signal words E. Parts of textbook/manual F. Following directions G. Outlining and note taking H. Interpretation of maps, graphs and charts I. Interpretation of diagrams, etc. J. Test taking skills K. Problem solving	A. Whole numbers B. Decimals C. Percentages D. Formulas E. Graphs	A. Solar system B. Gravity C. Weather D. Matter E. Chemical reactions F. Light G. Magnetism H. Heat I. Magnetism and electricity J. Nuclear energy K. Food production	A. The student will be able to list the typical voltage used in the devices of the topic B. The student will be able to list the available sources and/or devices used to produce the low voltage C. The student will be able to correctly interpret the related schematical symbols of the topic D. The student will be able to demonstrate skill in wiring a system that incorporates a lower control voltage

TOPIC: EXTERNAL CONTROL STATIONS AND SELECTOR SWITCHES

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Single position control II. Multi location control III. Selector switches	A. Description of the various types of control switches B. Explanation of the function of each C. Schematical symbol of each D. Typical wiring methods of each E. Practical application of the control devices F. Practical demonstration of wiring methods and techniques G. Related articles of the National Electrical Code to control wiring H. Practical assigned tasks	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Signal words F. Parts of textbook/manual G. Following directions H. Outlining and note taking I. Interpretation of maps, graphs and charts J. Interpretation of diagrams, etc.	A. Whole numbers B. Weights and measurements C. Graphs	Magnetism and electricity	A. The student will be able to identify the related types of control devices common to the trade B. The student will be able to list the schematical symbols for each C. The student will be able to interpret the wiring diagram of a typical control station D. The student will be able to demonstrate correct wiring to specific task

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Transformer control	A. Principles of inductions as related to transformers B. Types of transformers common to the trade C. Articles in the National Electrical Code that cover the use and installation of transformers D. Typical application of the devices in control wiring E. Schematical symbols of the types of transformers used in this unit F. Correct methods of wiring and over current protection means for the devices G. Methods of control; the typical devices that are common to the trade	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Signal words F. Parts of textbook/manual G. Following directions H. Outlining and note taking I. Interpretation of maps, graphs and charts J. Interpretation of diagrams, etc. K. Problem solving L. Spelling	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Ratio and proportion F. Powers and roots G. Formulas H. Graphs	A. Matter B. Magnetism C. Magnetism and electricity	A. The student will be able to list three types of transformers that are typical to this unit B. The student will be able to identify the correct terminals of "primary and secondary" windings C. The student will be able to state the principle of inductions D. The student will be able to demonstrate the method of connection of a control device to a transformer E. The student will be able to determine the correct application of the control device to the specific task

TOPIC: THREE PHASE REVERSING STARTERS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Three phase reversing starters	A. Principle of rotational direction change by inter-changing polarity B. Typical example of this interchange C. Addition to a magnetic starter of a interphasing device D. Schematical symbol of the device E. Typical wiring diagram and example of wiring methods employed in the trade F. Assigned task on a unit G. Demonstration of wiring a unit H. Pre-energizing checks to be employed prior to use of device	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Signal words F. Parts of textbook/manual G. Following directions H. Interpretation of maps, graphs and charts I. Interpretation of diagrams, etc. J. Test taking skills K. Problem solving L. Spelling M. Study skills	A. Whole numbers B. Formulas C. Graphs	Magnetism and electricity	A. The student will be able to identify the schematical symbols associated with the device B. The student will be able to state the principle of rotational change by inter polarity exchange C. The student will be able to demonstrate skill in following the wiring diagram of a unit D. The student will be able to demonstrate the completed task

UNIT: USE, INSTALLATION AND TROUBLESHOOTING INDUSTRIAL MOTOR CONTROLS - CONTINUED

TOPIC: INDICATOR LIGHTS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Indicator lights	A. Purpose of indicator lights B. Types of indicator lights C. Schematical symbols of each D. National Electrical Code related articles on topic E. Typical circuit connections for each type of light F. Series wiring of indicator lights G. Practical demonstration of a typical wiring of indicator lights in a related device H. Practical assigned task on wiring	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Signal words F. Parts of textbook/manual G. Following directions H. Outlining and note taking I. Interpretation of maps, graphs and charts J. Interpretation of diagrams, etc. K. Test taking skills L. Problem solving M. Spelling N. Study skills	A. Whole numbers B. Formulas C. Graphs	A. Light B. Magnetism and electricity	A. The student will be able to state the universal color codes of indicator lights B. The student will be able to demonstrate the methods of connecting the indicator light circuits to the specified devices C. The student will be able to synthesize an example of the use of this system for a specified task

UNIT: USE, INSTALLATION AND TROUBLESHOOTING INDUSTRIAL MOTOR CONTROLS - CONTINUED

TOPIC: TRANSISTORIZED RELAY CONTROLS

Task	Theory	Communication Skills	Mathematics Skills	Science Knowledge	Student Outcome
I. Transistorized relay controls	A. Explanation of what a transistor is B. Diagram and filmstrip on how a transistor works C. Typical application of the device in a control circuit D. Demonstration of the correct method of working with solid state devices and precautions of exposure to magnetic fields E. Use of meters to determine the voltage range of the operations voltage to the control voltage F. Typical wiring demonstrations G. Practical assigned task of wiring the device into a relay circuit	A. Functional reading skills B. Vocabulary C. Identifying main ideas D. Meanings in context E. Inferences F. Fact/Opinion distinction G. Signal words H. Parts of textbook/manual I. Following directions J. Outlining and note taking K. Interpretation of maps, graphs and charts L. Interpretation of diagrams, etc. M. Test taking skills N. Problem solving O. Spelling P. Study skills	A. Whole numbers B. Common fractions C. Decimals D. Percentages E. Weights and measurements F. Ratio and proportion G. Powers and roots H. Formulas I. Graphs	A. Matter B. Light C. Magnetism D. Heat E. Magnetism and electricity	A. The student will be able to recognize the schematical symbol for the transistor B. The student will be able to list the safety precautions in the use of the device C. The student will be able to understand how the transistor works D. The student will be able to demonstrate skill in wiring this device into a relay control circuit